EUV interference and proximity lithography

Valerie Deuter$^{1,2}$, Maciej Grochowicz$^{2,3}$, Sascha Brose$^4$, Jan Bußmann$^{2,5}$, Serhiy Danylyuk$^4$, Thomas Taubner$^3$, Detlev Grützmacher$^{1,5}$, Larissa Juschkin$^{2,5}$

$^1$ JARA-Institute Energy-Efficient Information Technology (PGI-10), Forschungszentrum Jülich GmbH, 52425 Jülich, Germany
$^2$ Experimental Physics of EUV, RWTH Aachen University, JARA-FIT, Steinbachstraße 15, 52074 Aachen, Germany
$^3$ Institute of Physics (IA), RWTH Aachen University, JARA-FIT, 52056 Aachen, Germany
$^4$ Chair for Technology of Optical Systems, RWTH Aachen University, JARA-FIT, Steinbachstr. 15, 52074 Aachen, Germany
$^5$ Forschungszentrum Jülich GmbH, Peter Grünberg Institut (PGI-9), JARA-FIT, 52425 Jülich, Germany

The dual grating approach is a common scheme for EUV interference lithography (IL), which allows reducing the feature size of periodic structures on a mask by a factor of two at wafer. The approach here is to fabricate a dual grating mask, which is suitable for illumination by a tabletop EUV plasma source with limited coherence length. Compared to synchrotron radiation, the radiation of a plasma source is less intense. This is advantageous from the point of view of mask fabrication as a high-efficiency phase-shift mask can be produced without technologically challenging structure transfer steps. The resist itself can act as a phase shifting medium and doesn’t degenerate under illumination with low intensity EUV radiation. For fabrication of periodic arrays of µm-size structures, i.e. infrared antennas, EUV IL can be useful for achieving sharp edges and small (nm-scale) structure features. In the proximity lithography, the diffraction by the µm-scale mask structures is in Fresnel regime. We report on the fabrication of a mask for Fresnel assisted proximity lithography, which has been designed by the use of iterative algorithms to find the mask layout, which leads to the desired structures on the wafer.